



CALIFORNIA DEPARTMENT OF TRANSPORTATION

BMP RETROFIT PILOT PROGRAM

**BASIS OF DESIGN REPORT
EXTENDED DETENTION BASIN DESIGN
DISTRICT 7 PS&E**

CALTRANS REPORT ID #: CTSW-RT-56-d1

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Prepared for:

**CALIFORNIA DEPARTMENT OF TRANSPORTATION
SACRAMENTO, CALIFORNIA**

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ACRONYMS

ac	Acre
acft	Acre feet
BMP	Best Management Practice
Caltrans	California Department of Transportation
cfs	cubic feet per second
gpm	gallons per minute
NRDC	National Resources Defense Council
PS&E	Plans, Specifications, and Estimates



1.0 INTRODUCTION

1.1 General (Purpose & Scope)

Pursuant to the Caltrans Consent Decree, a BMP Retrofit Pilot Program is required to investigate the constituent removal efficiency, technical feasibility and costs of retrofitting Caltrans facilities with selected Best Management Practices (BMPs). This report documents the design parameters associated with implementation of Best Management Practices for storm water discharges from two Caltrans District 7 PS&E facilities. Siting information for each of these locations is provided in the report entitled "Scoping Study, Retrofit Pilot Program, Caltrans District 7", dated April 28, 1998 by Robert Bein, William Frost & Associates (RBF). The BMP Pilot Projects discussed in this report are two extended detention basins.

1.2 Objectives

The purpose of this study is to provide design criteria in support of the construction drawings of the two BMP Retrofit Pilot Program projects. Specifically, the objectives of this report are as follows:

- Define hydrologic criteria for the design of the BMPs.
- Develop discharges for the design conditions above.
- Define hydraulic criteria for the design of the BMPs.
- Define design parameters for each BMP.
- Provide technical calculations supporting the drainage facility designs shown on the construction drawings.

1.3 Project Locations

The I-5/I-605 site is located in the City of Downey, and is bounded by the I-5 southbound freeway and the I-605 south/I-5 south connector. The I-605/SR91 site is located in the City of Cerritos, and is bounded by the I-605 southbound freeway, and the SR91 east/I-605 south connector.

1.4 Construction Drawings, Figures

Construction Drawings depicting the layout of the basins and the basin drainage plans are shown on Drawings L-1 through L-4 and Drawings D-1 through D-4, and are included in Appendix A. Photographs of the project sites are included in Appendix B as Figures 1, 2, 3 and 4.

1.5 Calculations

Calculations supporting the drainage facility designs shown on the construction drawings are included in Appendix C.

1.6 Construction Costs

The estimated construction costs for both detention basin sites is estimated to be \$218,041. A construction cost breakdown is included in Appendix D.

2.0 HYDROLOGIC CHARACTERISTICS

2.1 Rainfall Characteristics

The amount of rainfall from a 1 year, 24 hour storm was estimated in order to calculate storm water runoff for designing the detention basins. To develop rainfall values for the study area, Brown and Caldwell analyzed precipitation records (24-hour rainfall totals) for the Los Angeles International Airport (LAX) weather station from 1944 to 1995. Analysis was performed using the log-Pearson type III method and by the annual series data method. As a comparison to the LAX rainfall data, a second and third set of rainfall records were analyzed, using only an annual series data method, from the Van Nuys and the downtown Los Angeles weather stations. Both of these stations are located in the same rainfall region (coastal plain), as defined by the Los Angeles Department of Public Works (LACDPW), as the station at the LAX airport.

From the analysis, at the LAX weather station, the calculated 24-hour rainfall total for a one-year storm frequency event equaled 0.5-inches (log-Pearson) and 1.12-inches (annual series data method). The log-Pearson analysis was heavily influenced by two extreme drought years. The results for the Van Nuys and downtown Los Angeles stations were 0.71 and 0.73-inches respectively using the annual series data method. Because of the uncertainty of the exact size of a one-year frequency storm, a 1.0-inch value was chosen to represent the amount of rainfall for a one-year, 24-hour storm within the Los Angeles Coastal Plain (Caltrans Zone K). Because of the uncertainty of the method in the one-year analysis, a one-inch storm corresponds to about 1.2 year storm using the LAX weather station data and the log-Pearson analysis method. A rainfall zone map showing the extent of the rainfall zones within Caltrans District 7 is included in Appendix C.

2.2 Soil Types and Infiltration

Most soil types are acceptable for the construction of extended detention basins, as long as they are reasonably graded and able to be compacted. Soil at both the I-5/I605 site and the I-605/SR91 site has been previously disturbed, graded, and compacted during the construction of the interchange and therefore meet these criteria. The soil at the I-5/I-605 site has been identified as medium to coarse grained sands with some fine-grained sands, silty sand and silts. No geotechnical exploration or testing was performed at either site. Ground water is deep enough not

to influence the construction or operation of the basins. A geotechnical report prepared for the District 7 Retrofit Facilities identified 2:1 slopes as the steepest allowed at both the I-5/I-605 and the I-605/SR91 sites.

2.3 Methodology and Procedure

Design Storm Water Runoff Volume. A review of the Caltrans as-built drainage system drawings for the detention basin sites and tributary areas was made to determine the total tributary drainage area to the basins. The total tributary area was separated into pervious and impervious areas. Figures E1 and E2 included in Appendix E identify the tributary drainage areas for each site. The total runoff volume for the 1-year, 24 hour storm was then calculated using the following assumptions (per Appendix D of the “Caltrans California Storm Water Best Management Practice Handbook, Municipal.”):

- 0.06-inches of rainfall captured in local depressions,
- Runoff coefficient of 0.9 for impervious surfaces,
- Runoff coefficient of 0.15 for pervious surfaces.

Calculations for the design storm water runoff volume are included in Appendix C.

The opportunity to direct more storm water runoff to the basins was examined and found to be impractical and costly. Modifications to the existing drainage systems, i.e. boring large diameter pipes under the existing freeway and connectors in order to maintain positive drainage to and from the basins, would be required.

Peak Storm Water Flow Rate. The modified Rational Method was used to develop the peak storm water flow rate to the basins. This is the same method used in the Caltrans District 7 Hydraulics Manual which is based upon the Los Angeles Department of Public Works (DPW) method. DPW is responsible for providing flood control protection in Los Angeles County.

The design storm rainfall intensity values were determined by evaluating average intensity duration curves from the District 7 Hydraulics Manual. Although the peak intensity is only available for a 10-year, 25-year, and 50-year storms, a conversion curve is available to convert a 50-year storm intensity to a one-year storm. The conversion curve, from the District 7 Hydraulics Manual, page III-038, was used to convert the 50-year peak intensity values to the 1-year, 24-hour design storm by multiplying the 50-year rainfall intensity value by 0.445 (this conversion value is provided on the curve). The peak storm water flow rate was then calculated by multiplying the peak rainfall intensity value in inches/hour by the total impervious drainage area, and then converting to gallons per minute (gpm).

A duration of peak rainfall equal to the time of concentration was used to determine peak rainfall from the curves. Concentration times of 2 minutes and 10 minutes were used for the I-605/SR91 and I-5/I-605 sites respectively.

Calculations for peak storm water flow rates, including copies of the 50-year Average Intensity Duration Curve and the Conversion Curve are included in Appendix C.

2.4 Summary of Results

A summary of the parameters used and the storm water runoff volume and peak storm water flow rates are presented below:

Parameter	I-5/I-605 Site	I-605/SR91 Site
Drainage Area, acres	6.8	0.8
% Impervious	54	100
Rainfall Zone	K	K
Total Rainfall, inches	1	1
Time of Concentration, minutes	10	2
Peak Rainfall, inches/hour	1.41	1.87
Peak Storm Water Flow Rate, gpm	2,343	677
Runoff Volume, gallons	96,325	18,377

3.0 WATER QUALITY DESIGN DISCUSSION AND ASSUMPTIONS

3.1 Design Criteria

The primary function of the extended detention basins is to provide settlement of particulate pollutants from storm water runoff. In addition, heavy metals and other toxic chemicals that will attach to particulate matter will also be removed. In order to maximize the effectiveness of the basins to protect water quality, various design criteria were used in the basin design including detention time, water depth, and basin geometry, and are discussed below.

Recommended design criteria per the Scoping Study include a detention time of 24 hours for average conditions. Length to width ratios for the basin of 3:1 or greater and pond depths of 4 to 6 feet are also recommended. Basin side slopes should not exceed 2:1, with slopes of 4:1 or flatter preferred per the Study.

3.2 System Design

Water Depth. Although shallower depths in detention basins can theoretically improve the particle removal efficiencies, there is a potential problem with resuspension of settled material. Resuspension can occur during the first flush of subsequent storm events or can result from wind and waves creating turbulence near the bottom of the basin. A basin depth of 2 feet for the design storm volume was selected for providing good particulate removal while preventing resuspension.

Basin Geometry. Since the basins are designed to function essentially as fill and draw treatment facilities by restricting the outflow, the potential for short circuiting is considered to be relatively minor. However, to further minimize potential short circuiting and increase treatment

efficiency, the hydraulic flow length has been maximized by providing a length to width ratio of 4.5 at the I-5/I-605 site and 9.0 at the I-605/SR91 site. Basin side slopes are 4:1 except along the existing slope adjacent to the freeway which is approximately 2:1 at both the I-5/I-605 and the I-605/SR91 sites.

The sites were larger than needed for the flow anticipated. If basins were designed to cover more of the site, then the depth of the water would decrease and resuspension of solids would occur as discussed in the previous on Water Depth.

Basin Location. Basins at both sites were located adjacent and parallel to the freeway, making use of the existing slope, thereby minimizing costs by reducing berm construction, fill quantities, inlet piping, grading and removal of existing vegetation and trees. The I5/I605 site has a thick growth of small trees, shrubs and brush on the west side of the site. By keeping the detention basin to the center and east side of the site we were able to leave the portion of the landscaping on the west slope intact.

Detention Time. For water depths up to 3 feet (the top of the outlet structure), the entire stored volume in the basin will drain through the perforations in the stand pipe at the outlet structure. The number, location and size of the perforations in the stand pipe was determined in order to provide an average of approximately 72 hours of detention time for a range of depths in the basins. The estimated drainage times for various water depths is presented below:

Site	Water Depth, ft	Time of Drainage, hours
I-5/I-605	1	56
	2	70
	3	76
I-605/SR91	1	67
	2	81
	3	86

Calculations for time of drainage are included in Appendix B.

4.0 HYDRAULIC ANALYSES

4.1 Design Criteria

The peak storm water flow rates (see Section 2.4) to the basins were used to determine the required capacity for the piping conveying flow to the basins and for the emergency spillways. Calculations for the piping and spillways are included in Appendix B. A pipe diameter of 24 inches was considered as the minimum pipe size to allow reasonable access for flow metering and sampling.

4.2 System Design

I-5/I-605 Site. Flow to this site is carried by an existing 5 feet by 2 feet reinforced concrete box (RCB) culvert located under the I-5 freeway (see Figure 5, Appendix A). A concrete inlet structure will be constructed where the RCB enters the site to redirect flows from the RCB to the basin. An emergency weir overflow is provided at the inlet structure. From the inlet structure the flow is conveyed to the basin through a new 24-inch reinforced concrete pipe (RCP) to the detention basin. An in-line sample box is provided to allow collection of a sample for water quality analysis and access to a flow meter. A flap gate connected at the end of the inlet RCP piping will provide a minimum amount of head upstream and create the depth of flow needed to measure the incoming flow. Rock slope protection is provided at the inlet to the basin to prevent reduce the velocity and spread the flow where it enters the basin.

The detained water in the basin is discharged slowly through the perforations in the stand pipe at the outlet structure. Three rows of perforations are provided, the bottom row 3 inches above the basin bottom, the middle row 1.3 feet above the bottom, and the top row 2.3 feet above the bottom. Each row consists of 2 perforations at a 180 degree spacing. Perforations for the bottom row are 1-inch diameter; perforations for the middle and top rows are 1 ½-inch diameter. Crushed rock is placed around the stand pipe to minimize the potential for clogging of the perforations by debris and trash.

For water depths up to 3 feet, the detained volume will be discharged entirely through the orifices in the stand pipe. Above 3 feet, the water will flow into the top of the outlet structure. If the water depth continues to rise to more than 4 feet, the water will overflow the emergency spillway at the inlet structure.

From the basin outlet structure, the flow is conveyed through a 24-inch RCP pipe. An in-line sample box is provided to allow collection of a sample for water quality analysis and access to a flow meter. A flap gate connected at the end of the outlet RCP piping will provide a minimum amount of head upstream and create the depth of flow needed to measure the outgoing flow. Rock slope protection is provided at the end of the outlet piping to reduce the velocity and spread the flow where it exits the basin.

The area outside of the basin will be graded to direct flow to the existing 6 feet by 3 feet RCB which drains the site. Basin slopes will be stabilized using the hydroseed mix described in RBF's Design Directive #6 and approved by Ms. Martha Blane. Specifications for the hydroseed mix are included in Appendix F.

The primary design constraint at the I-5/I-605 site was the very limited elevation change from the culvert entering the site to the culvert exiting the site. The difference between the inlet and outlet was only 1.4 feet. Therefore, the decision was made to limit the depth of the basin to 2 feet for the design storm, even though most detention basins are designed to be deeper than this. Even the 2 feet depth results in some backwater into the existing upstream culvert but will not significantly effect upstream hydraulics.

Initially two areas were assumed to be able to be included in the tributary area to the detention basins which later were excluded. They are:

- the area on the east side of Route 5 including part of the highway and the open space between I5 and connector roads (identified as X3 in Figure E1, Appendix E), and
- the area on the west side of Route 5 in which the detention basin is located, including part of the highway (identified as X4 in Figure F1).

Runoff enters Area X4 from two downdrains from the Route 605/Route 5 connector, a culvert from Area X3, a culvert from the interchange area east of Route 5 and north of Route 605 (Area X5) with an invert elevation of 118.2, a down drain from Route 5 and precipitation onto Area X4. Runoff exits Area X4 by way of a box culvert with invert elevation of 116.8. Therefore the existing elevation difference between the inlet culvert from Area X5 and the outlet of Area X4 is only 1.4 feet. The elevation of the culvert from Area X3 is essentially the same as that of the outlet from Area X4.

The detention basin design includes the all flow from Area X5, which incorporates flow from other adjacent pervious and impervious areas. However, flow from Area X3, including runoff from the east side of the freeway, cannot be included because the inlet and outlet pipes to the detention basin site are at the same elevation, allowing for no depth of storage. In order to increase the basin depth to allow inclusion of runoff from Area X3, the outlet from X4 would need to be lowered three to four feet. However, this is not hydraulically feasible, because the outlet pipe discharges to the bottom of an adjacent portion of the interchange which in turn discharges to a double 6' by 3' box culvert. By lowering the upstream piping, all of the downstream piping would also need to be lowered to allow the system to drain. For this reason, this option was not considered further.

Another alternative would be to raise the culvert from Area X3. This would require abandoning the existing culvert under Route 5, boring another 24-inch culvert under Route 5, adding 4 feet of fill to the pervious area of X3, and replacing the 24-inch RCP across the North 605/North 5 connector to allow a shallower depth. The estimated cost of such work is shown in the following table. The costs for such work amount to over three times the cost of the rest of the work, making it not feasible.

Item	Unit	Quantity	Unit Cost (\$)	Extended Cost (\$)
I5 Crossing				
Jacking Pit	EA	1	50,000	50,000
Receiving Pit	EA	1	30,000	30,000
Boring	LF	200	450	90,000
Headwalls	EA	2	2,500	5,000
Abandon Existing Culvert	LS	1	2,000	2,000
N605/N5 Connector Crossing				
Jacking Pit	EA	1	50,000	50,000

Item	Unit	Quantity	Unit Cost (\$)	Extended Cost (\$)
Receiving Pit	EA	1	50,000	50,000
Boring	LF	75	450	34,000
Headwalls	EA	1	3,000	3,000
Abandon Existing Culvert	LS	1	2,000	2,000
Traffic Control	LS	1	5,000	5,000
Modifications to Freeway Drains	LS	1	20,000	20,000
Fill (Imported) Site X3	CY	3,000	3	9,000
Fill (Imported) Site X4	CY	700	3	2,000
Modifications to existing downdrains	LS	1	2,000	2,000
Contingency (20%)				71,000
Total				425,000

In addition, the existing culvert across I5 presently has about 9 feet of cover. By raising it 4 feet, this would reduce the cover to 5 feet, which is near the acceptable cover allowed by Caltrans for boring or jacking pipes to prevent settling or other physical disturbance in the roadway. This situation would need to be investigated further to determine if this option would be allowed.

The top of the detention basin as designed is about 4 feet above existing ground. This allows the runoff from the east side of Route 5 (Area X5 and others) to flow into the basin and then flow into the existing 24-inch outlet from Area X4. The freeway runoff discharges to the site at the south end, which is over 30 feet from the primary flow at the north end of the site. For runoff from Area X4 to flow into the detention basin, the ground elevation would need to be raised throughout the site. The elevation would need to be approximately the same elevation as the top of the detention basin, to allow drainage to the basin. However, the drainage path from the overflow for inlet to Area X4 (from Area X5) cuts across the site at the existing ground elevation making this impractical.

I-605/SR91 Site. Flow to this detention basin is carried by two existing 12-inch corrugated steel pipe (CSP) downdrains. A manhole will be constructed at each of these drains to intercept and direct the drainage flows to two new 12-inch CSP drains. The new drains combine at a common new manhole which is connected to a 24-inch RCP pipe which conveys the flow to the basin. An in-line sample box is provided to allow collection of a sample for water quality analysis and access to a flow meter. A flap gate connected at the end of the inlet RCP piping will provide a minimum amount of head upstream and create the depth of flow needed to measure the incoming flow. Rock slope protection is provided at the inlet to the basin to prevent reduce the velocity and spread the flow where it enters the basin.

The detained water in the basin is discharged slowly through the perforations in the stand pipe at the outlet structure. Three perforations are provided, located at the basin bottom, 1.0 feet above the bottom, and 2.0 feet above the bottom. Diameters for the bottom, middle, and top perforations are ½-inch, 1-inch, and 1 ½-inches respectively. Crushed rock is placed around the water quality pipe to minimize the potential for clogging of the orifice.

For water depths up to 3 feet, the detained volume will be discharged entirely through the water quality pipe. Above 3 feet, the water will flow over the top of the outlet structure. If the water depth continues to rise to more than 4 feet, the water will overflow the emergency spillway at the top of the basin dike.

From the outlet structure, the flow is conveyed through a 24-inch RCP pipe. An in-line sample box is provided to allow collection of a sample for water quality analysis and access to a flow meter. A flap gate connected at the end of the outlet RCP piping will provide a minimum amount of head upstream and create the depth of flow needed to measure the outgoing flow. Rock slope protection is provided at the end of the outlet piping to reduce the velocity and spread the flow where it exits the basin.

The area outside of the basin will be graded to direct flow to the existing 24-inch RCP culvert which drains the site. Basin slopes will be stabilized using the hydroseed mix described in RBF's Design Directive #6 and approved by Martha Blane. Specifications for the hydroseed mix are included in Appendix F.

Initially two areas were assumed to be able to be included in the tributary area to the detention basins which were later excluded (see figure in Appendix A). They are:

- the 2.5 acres on the east side of Route 605 (identified as X1 in Figure E2, Appendix E), and
- the 2.2 acres on the west side of Route 605 in which the detention basin is located (identified as X2 in Figure E2).

Runoff enters Area X2 from two downdrains from Route 605, a culvert from Area X1 with invert elevation of 61.3, and precipitation onto Area X2. Runoff exits Area X2 by way of a 24-inch culvert with invert elevation of 60.1. Therefore, the existing elevation difference between the inlet culvert from Area X1 and the outlet of Area X2 is only 1.2 feet.

If flow from Area X1 was included, considering elevation loss through the system, the maximum basin depth could only be about 0.75 feet, less for the design storm. This depth is far below typical detention basin depths of 4 to 8 feet and will cause resuspension of bottom sediment due to the inflow to the basin and surface currents due to winds. In order to increase the basin depth to allow inclusion of runoff from Area X1, the outlet to X2 would need to be lowered three to four feet. However, this is not feasibly possible, because the outlet pipe discharges to the bottom of an existing storm drain channel which in turn feeds a drainage culvert under Artesia Boulevard. Therefore the outlet pipe cannot be lowered without affecting the entire downstream piping system. For this reason, this option was not considered further.

Another alternative would be to raise the culvert from Area X1. This would require abandoning the existing culvert, boring another 24-inch culvert under Route 605, and adding 4 feet of fill to the pervious area of X1 (about 1.5 acres). Fill would need to be added to Area X2 to provide soil coverage for the pipe, and the culvert. Below is a cost estimate for this work.

Item	Unit	Quantity	Unit Cost (\$)	Extended Cost (\$)
Jacking Pit	EA	1	50,000	50,000
Receiving Pit	EA	1	30,000	30,000
Boring	LF	150	450	60,000
Headwalls	EA	2	2,500	5,000
Abandon Existing Culvert	LS	1	2,000	2,000
Fill (Imported) Site X1	CY	5,000	3	15,000
Fill (Imported) Site X2	CY	700	3	2,000
Modifications Area X1 downdrains	LS	1	2,000	2,000
Contingency (20%)				29,000
Total				195,000

This about triples the cost of the detention basin construction. Additional evaluation would be required to evaluate the affect of raising the grades on the upstream and hydraulics the affect on the storage volume of Area X1. This substantial increase in basin cost made this option impractical.

The top of the detention basin as designed is about 4 feet above existing ground. This allows the runoff from the west side of Route 605 to flow into the basin and then flow into the existing 24-inch outlet from Area X2. For the non-highway runoff of Area X2 to flow into the detention basin, the ground elevation would need to be raised throughout the site. The elevation would need to be approximately the same elevation as the top of the detention basin, to allow drainage to the basin. However, the drainage path from the inlet to Area X2 (from Area X1) cuts across the site at the existing ground elevation making this impractical.

4.3 Assumptions

To verify that the capacity of the of the inlet and outlet piping was adequate, the following pipe roughness coefficients were used:

Pipe material	Roughness Coefficient
Corrugated Steel Pipe	0.03
Reinforced Concrete Pipe	0.013

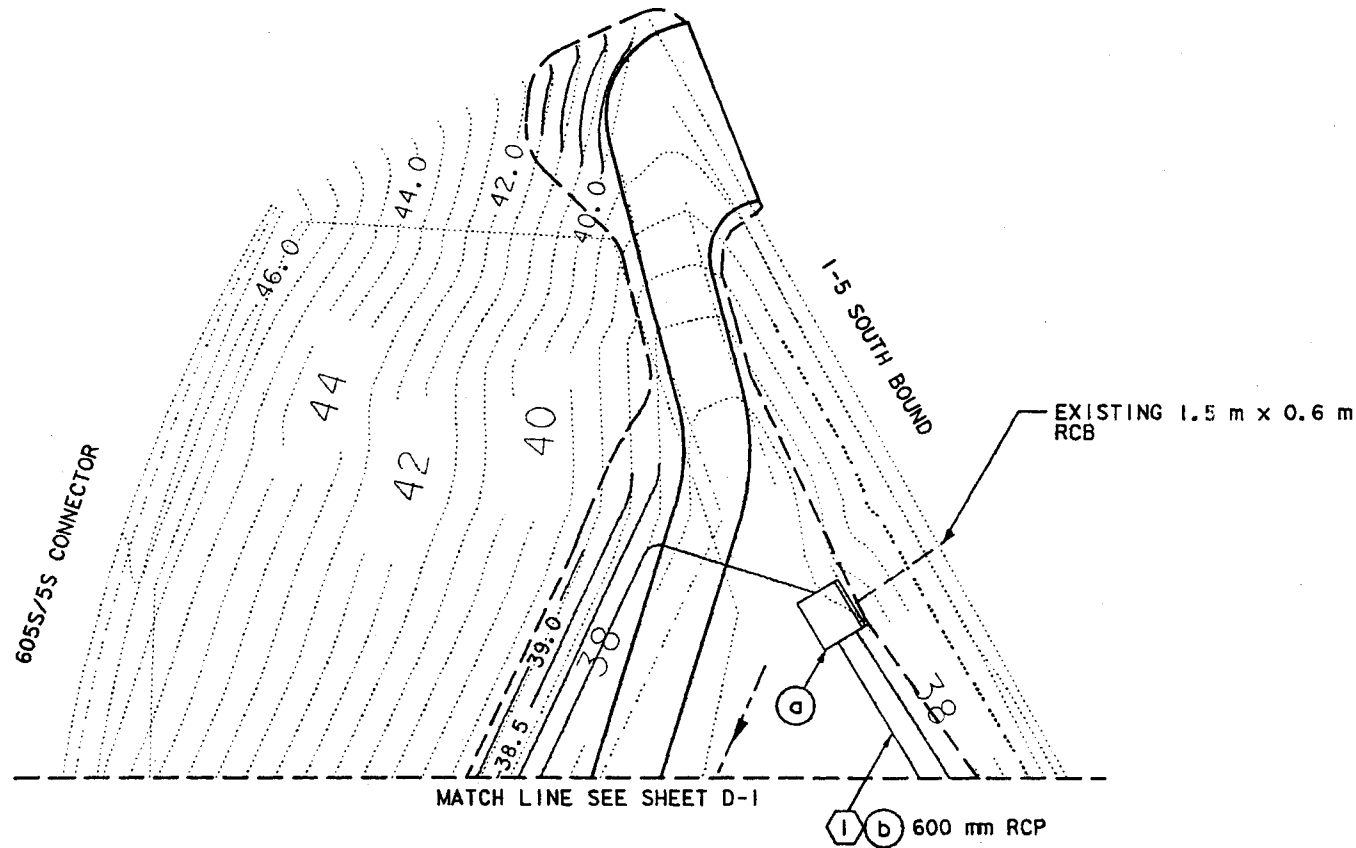
REFERENCES

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- California Department of Transportation. As-built drainage system drawings.
- California Department of Transportation, District 7, 1985. *Hydraulic Design and Procedures Manual.* Ed. by Herman and Polimeni.
- Camp Dresser and McKee Inc., et al, March 1993. *California Storm Water Best Management Practice Handbook, Municipal.*
- Camp Dresser and McKee Inc., September 1997. *Caltrans Storm Water Quality Handbook, Planning and Design Staff Guide.*
- The L.K.R. Group, March 20, 1998. *Revised Pre-Construction Geotechnical Evaluation Report, Caltrans Storm Water Runoff Study Retrofit Facilities, District 7, Los Angeles County, California.*



APPENDIX A

EXTENDED DETENTION BASIN LAYOUT AND DRAINAGE PLANS



DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	5. 605	7.5 10.9		

REGISTERED CIVIL ENGINEER	DATE
DOUGLAS B. ROBISON	
No. 37109	
Exp. 06-30-00	
CIVIL	

PLANS APPROVAL DATE

X

BROWN AND CALDWELL
16735 VON KARMAN
IRVINE, CA 92606

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LEGEND

- DRAINAGE SYSTEM NO
- DRAINAGE UNIT
- PAVED ACCESS ROAD
- DIRECTION OF FLOW

I-5/I-605
EXTENDED DETENTION BASIN

THIS PLAN SHEET ACCURATE
FOR DRAINAGE WORK ONLY

ALL DIMENSIONS ARE IN
METERS UNLESS OTHERWISE SHOWN

DRAINAGE PLAN

SCALE 1:200

DATE: 01/15/99 BY: JLD

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION



DESIGN OVERSIGHT

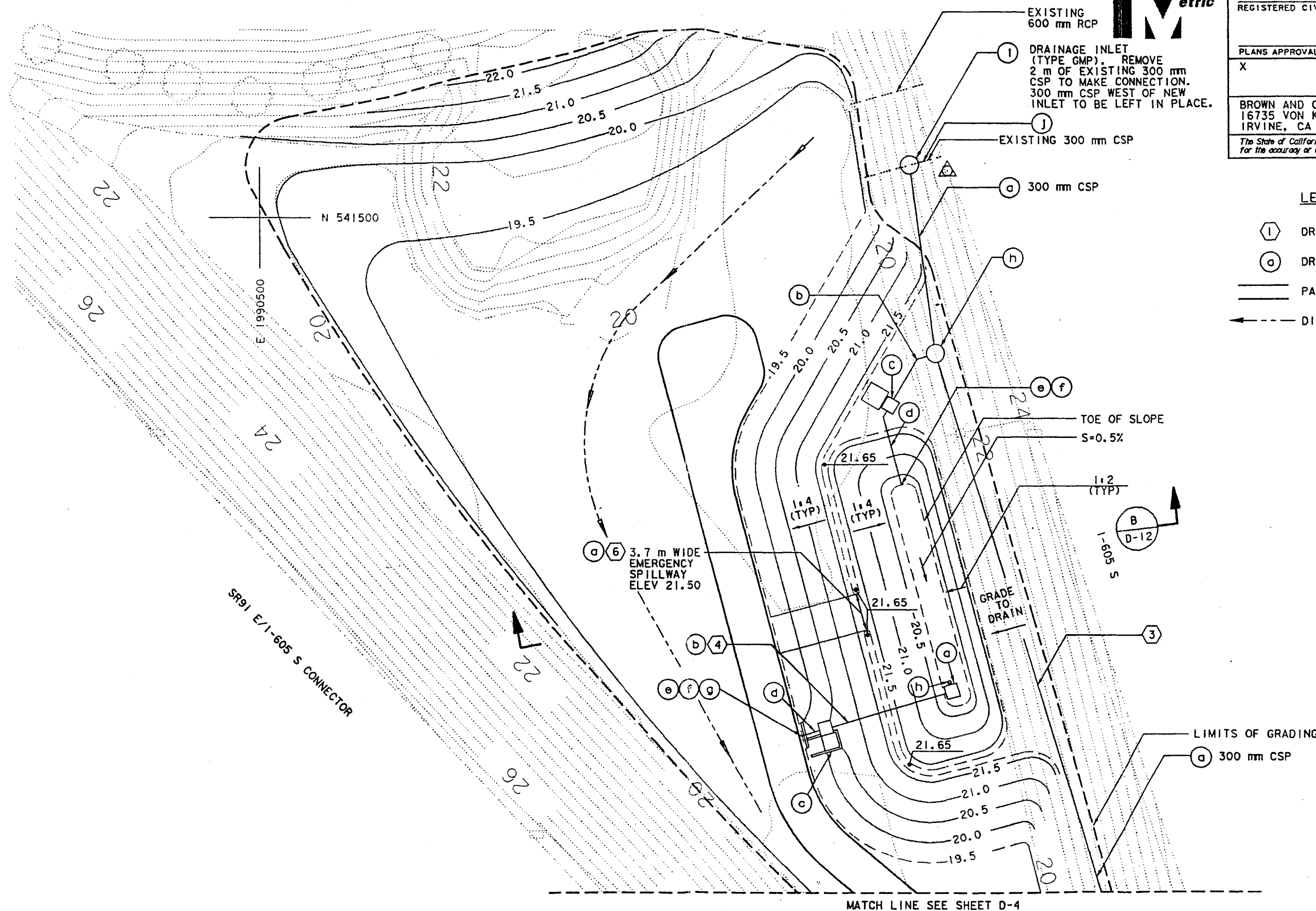
REFUGIO DOMINGUEZ

CALCULATED/DESIGNED BY

CHECKED BY

DATE REVISED BY

DATE REVISED



**I-605/SR91
EXTENDED DETENTION BASIN**

THIS PLAN SHEET ACCURATE
FOR DRAINAGE WORK ONLY

ALL DIMENSIONS ARE IN
METERS UNLESS OTHERWISE SHOWN

DRAINAGE PLAN

SCALE 1:200

D-3



DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	5,605	7.5 10.9		
REGISTERED CIVIL ENGINEER DATE					
PLANS APPROVAL DATE					
X					
BROWN AND CALDWELL 16735 VON KARMAN IRVINE, CA 92606					
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.					

REGISTERED PROFESSIONAL ENGINEER

DOUGLAS B. ROBINSON

No. 37109

Exp. 06-30-00

CIVIL

STATE OF CALIFORNIA

LEGEND

- DRAINAGE SYSTEM NO
- DRAINAGE UNIT
- PAVED ACCESS ROAD
- DIRECTION OF FLOW



APPENDIX B

EXTENDED DETENTION BASIN PHOTOGRAPHS



FIG. 1
I5/I605 EXTENDED DETENTION BASIN

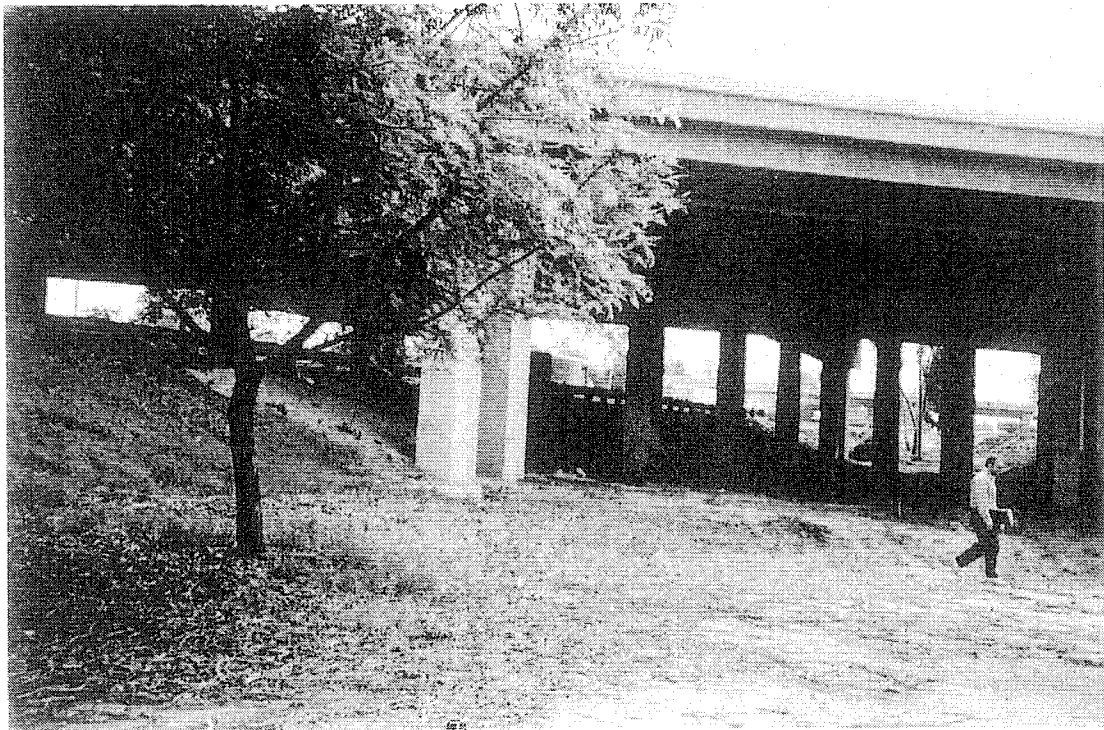
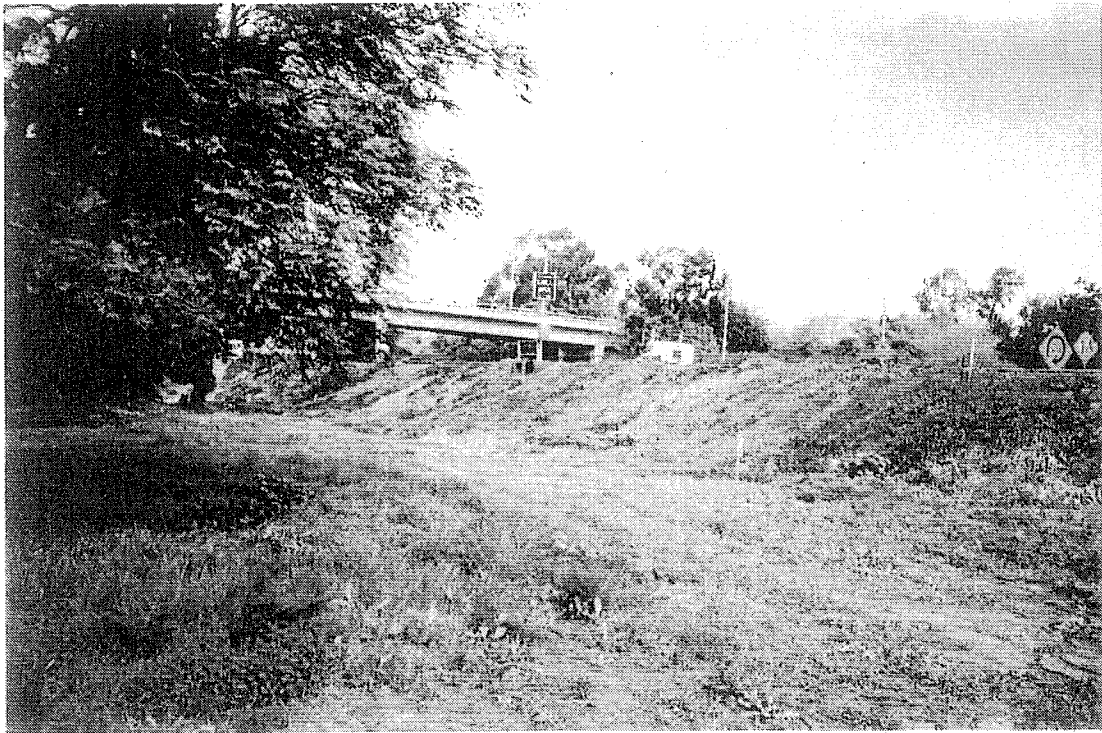


FIG. 2
I5/I605 EXTENDED DTENTION BASIN

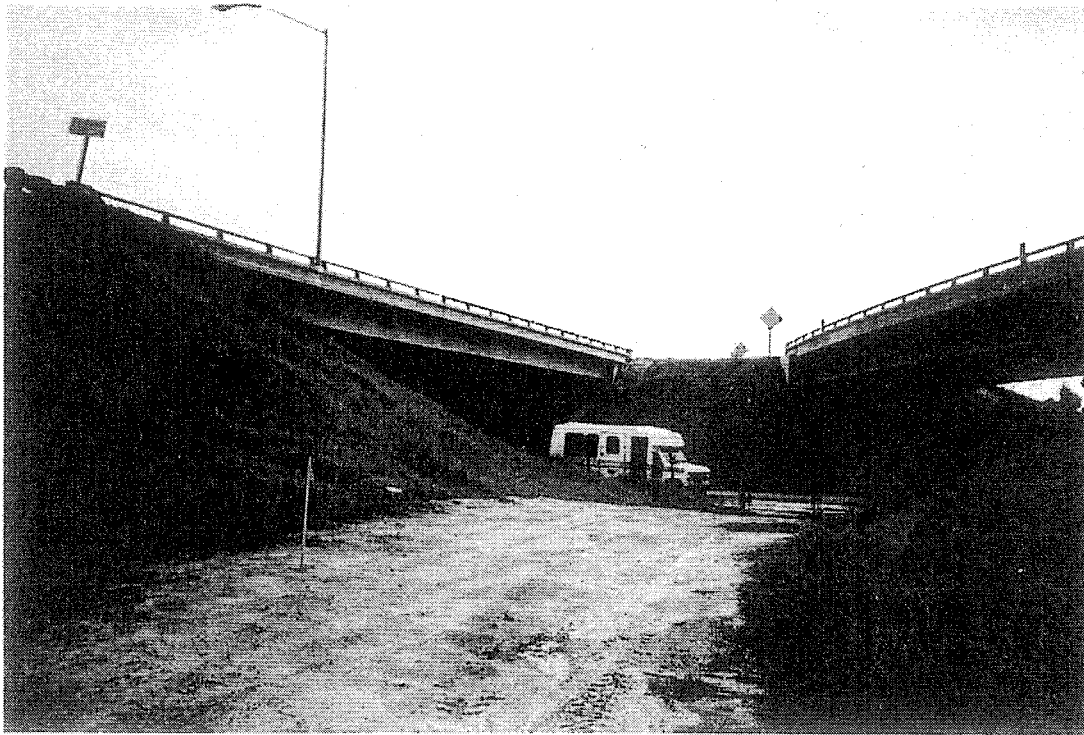


FIG. 3
I605/SR91 EXTENDED DETENTION BASIN



FIG. 4
I605/SR91 EXTENDED DETENTION BASIN

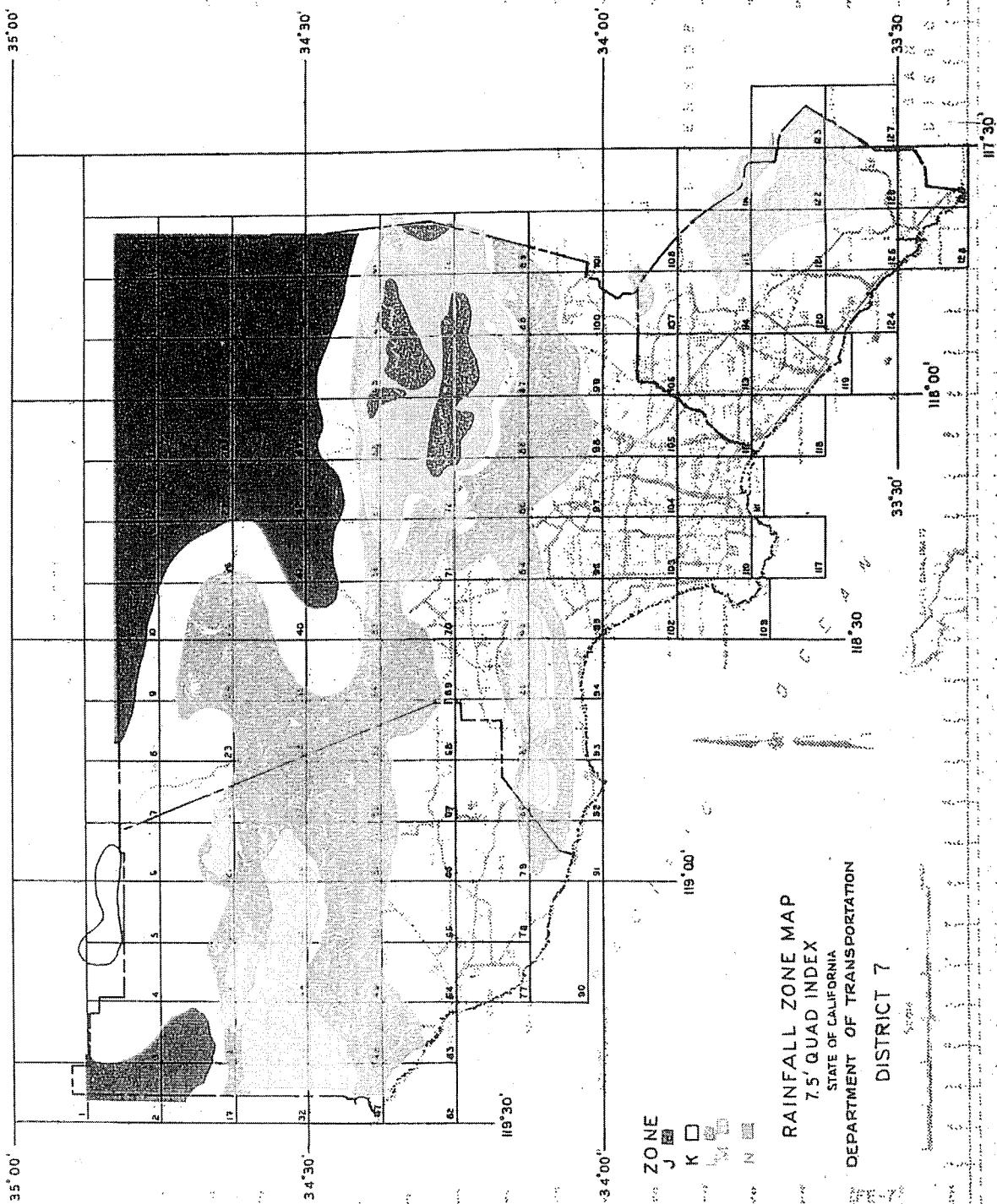


APPENDIX C

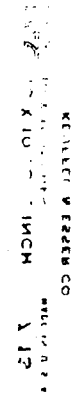
EXTENDED DETENTION BASIN CALCULATIONS

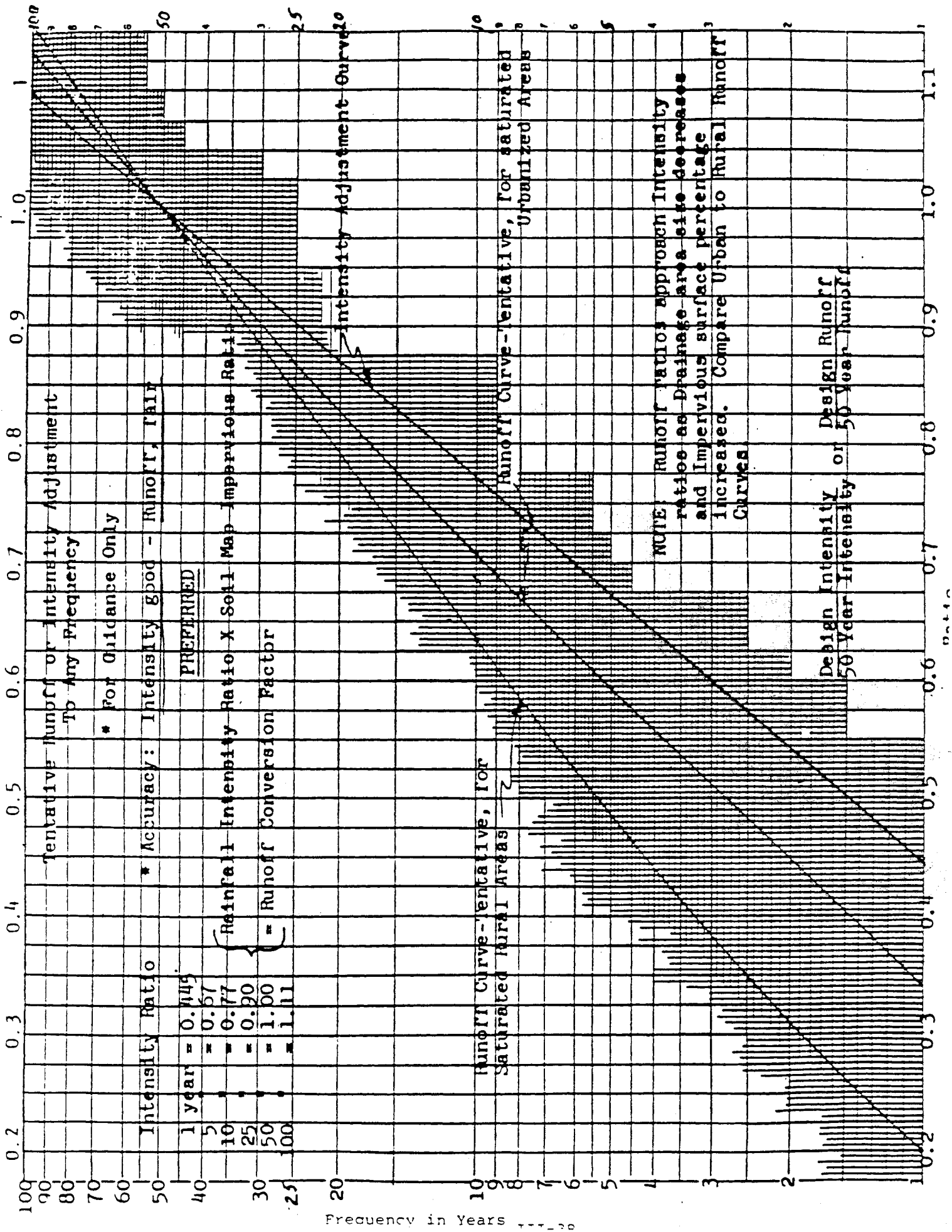
RAINFALL ZONE MAP

- | | |
|--------------------------|-------------------------|
| 1 Ballinger Canyon | 66 Moorpark |
| 2 Cuyana Peak | 67 Simi |
| 3 Apache Canyon | 68 Santa Susana |
| 4 Sawmill Mountain | 69 Oak Mountain |
| 5 Cuddy Valley | 70 San Fernando |
| 6 Frazier Mountain | 71 Sunland |
| 7 Lebec | 72 Condor Peak |
| 8 La Libre Ranch | 73 Chibco Flat |
| 9 Neenoch School | 74 Waterman Mountain |
| 10 Fairmont Butte | 75 Crystal Lake |
| 11 Little Buttes | 76 Mt. San Antonio |
| 12 Rosamond | 77 Oxnard |
| 13 Rosamond Lake | 78 Camarillo |
| 14 Redman School | 79 Newbury Park |
| 15 Mount Mesa | 80 Thousand Oaks |
| 16 Kramer | 81 Calabasas |
| 17 Rancho Nuevo Creek | 82 Canoga Park |
| 18 Reyes Peak | 83 Van Nuys |
| 19 San Guillermo | 84 Burbank |
| 20 Lockwood Valley | 85 Pasadena |
| 21 McDormid Peak | 86 Mt. Wilson |
| 22 Black Mountain | 87 Azusa |
| 23 Liebre Mountain | 88 Glendora |
| 24 Burnt Peak | 89 Mt. Baldy |
| 25 Lake Hughes | 90 Point Mugu |
| 26 Del Sur | 91 Triunfo Pass |
| 27 Lancaster West | 92 Point Dume |
| 28 Lancaster East | 93 Melibu |
| 29 Alpha Butte | 94 Topanga |
| 30 Hi Vista | 95 Beverly Hills |
| 31 Adobe Mountain | 96 Hollywood |
| 32 Old Man Mountain | 97 Los Angeles |
| 33 Wheeler Springs | 98 El Monte |
| 34 Lion Canyon | 99 Baldwin Park |
| 35 Topatopa Mountain | 100 San Dimas |
| 36 Devils Heart Peak | 101 Ontario |
| 37 Cobblesstone Mountain | 102 Venice |
| 38 Whittaker Peak | 103 Inglewood |
| 39 Warm Springs Mountain | 104 South Gate |
| 40 Green Valley | 105 Whittier |
| 41 Sleepy Valley | 106 La Habra |
| 42 Ritter Ridge | 107 Yorba Linda |
| 43 Palmdale | 108 Prado Dam |
| 44 Littlerock | 109 Redondo Beach |
| 45 Lovejoy Bufiles | 110 Torrance |
| 46 El Mirage | 111 Long Beach |
| 47 White Ledge Peak | 112 Los Alamitos |
| 48 Melitje | 113 Anaheim |
| 49 Ojai | 114 Orange |
| 50 Santa Paula Peak | 115 Black Star Canyon |
| 51 Fillmore | 116 Corona South |
| 52 Piru | 117 San Pedro |
| 53 Val Verde | 118 Seal Beach |
| 54 Newhall | 119 Newport Beach |
| 55 Mint Canyon | 120 Tustin |
| 56 Agua Dulce | 121 El Toro |
| 57 Acton | 122 Santiago Peak |
| 58 Pacifico Mountain | 123 Alhambra |
| 59 Juniper Hills | 124 Laguna Beach |
| 60 Valerino | 125 San Juan Capistrano |
| 61 Mescal Creek | 126 Canada Gobernadora |
| 62 Pitas Point | 127 Sifton Peak |
| 63 Ventura | 128 Dana Point |
| 64 Salcedo | 129 San Clemente |



PROBABLE 50 YEAR FREQUENCY OF RAINFALL FOR DISTRICT VII





SS/S605 Site - Determine Basin Dimensions

Volume of Runoff - 1 yr, 24 hr storm = 96,325 gallons
= 12,878 cf

Assume 2' water depth

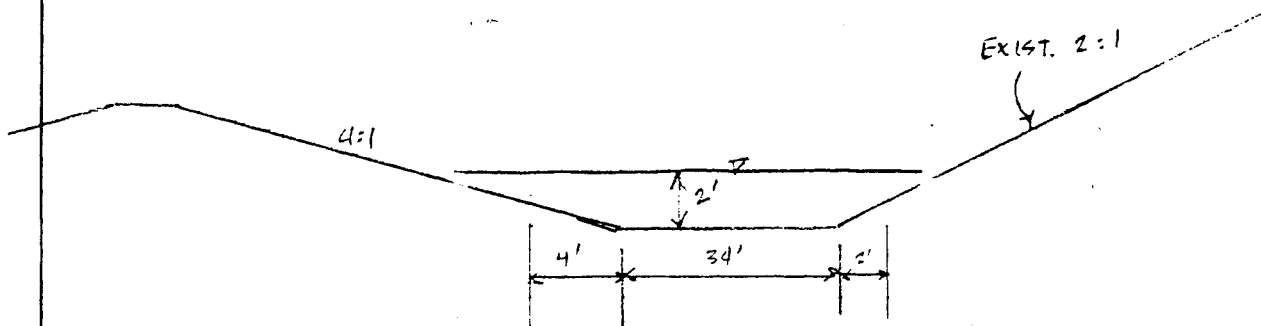
Assume $L:W = 4:1$

$$2' \times L \times 4 = 12,878 \text{ cf}$$

$$L^2 = 25,756$$

$$L = 160 \text{ ft}$$

$$W = 40 \text{ ft}$$



base dimensions = 34' x 152'

6160-20.5
JOB NUMBER

CF
BY

SS/S605 Site

SUBJECT

3/11/98
DATE

SHEET NO.
1

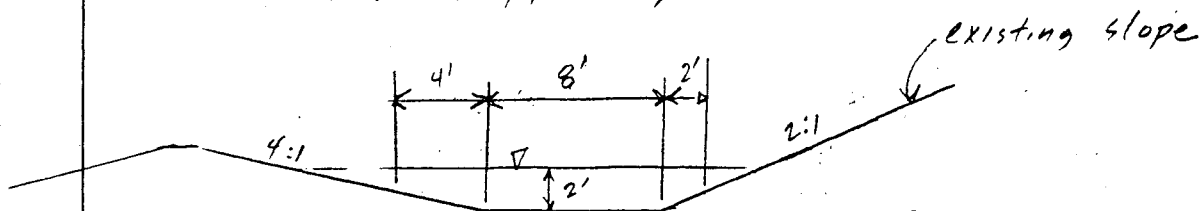
I-605/SR91 Site - Basin Dimensions

Volume of Runoff 1 yr, 24 storm = 18,377 gallons
= 2,457 cf

Assume 2' water depth

Assume $L:W = 4:1$

$$2' \times L \times W/4 = 2,457 \text{ cf}$$



$$L_{avg} \times W_{avg} \times 2' = 2,457 \text{ cf}$$

$$W_{avg} = 8' + 4' + 2' = 14' = 4.3 \text{ m}$$

$$L_{avg} = \frac{2,457}{2 \times 14} = 87.15' \rightarrow \text{use } 82' = 25 \text{ m}$$

$$\text{Base Dimensions} = 8' \times 74'$$

$$\text{Height of berm} = 4.5 \text{ ft} = 1.37 \text{ m}$$

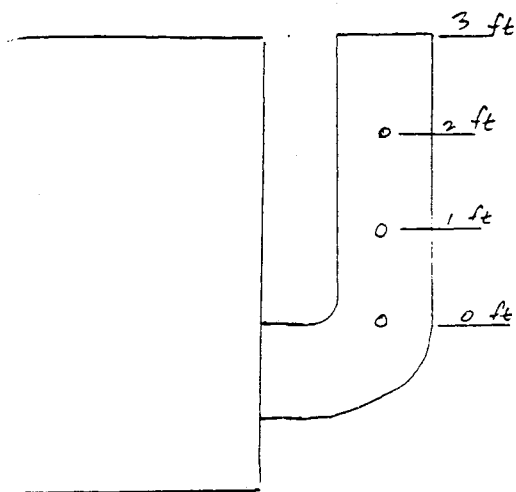
Top of Berm Dimensions:

$$L = 74' + 4.5(4)(2) = 110 \text{ ft} = 33.53 \text{ m}$$

$$W = 8' + 4.5(4) + 4.5(2) = 35 \text{ ft} = 10.67 \text{ m}$$

		6'60-20.5	CF	3/9/98		SHEET NO. 1/1
DATE CHECKED	CHECKED BY	JOB NUMBER	BY	DATE	CALC. NO.	
I-605/SR91		Extended Detention Basin Sizing				
PROJECT		SUBJECT				

Estimate Time of Drainage Through Orifices in Stand Pipe



$$T_d = \text{Time of drainage, hrs} = \frac{V}{Q}$$

where V = Volume of water, cf

$$Q = \text{Average flow rate, cfs} \\ = q_0 + q_1 + q_2$$

where q_0 = flow through orifice at level 0

q_1 = flow through orifice at level 1

q_2 , etc.

$$q = CA\sqrt{2gh}$$

A = area of orifice, ft^2

C = orifice coefficient, assume 0.66

h = head causing flow, ft

DATE CHECKED	CHECKED BY	JOB NUMBER	BY	DATE	CALC. NO.	SHEET NO. 1/3
PROJECT CMT TRANS		SUBJECT Extended Detention Basins - Time of Drainage				

To drain from 3 ft to 2 ft:

$$T_d = \frac{V_3 - V_2}{Q_{avg}} \times \frac{LW}{3600 \text{ sec}}$$

$$= \frac{LW(3-2)}{\frac{1}{2}(Q_3 + Q_2)} \times \frac{1}{3600}$$

$$= \frac{LW(3-2)}{\frac{1}{2} C \sqrt{2g} [a_0(\sqrt{3} + \sqrt{2}) + a_1(\sqrt{2} + \sqrt{1}) + a_2(\sqrt{1} + \sqrt{0})]} \times \frac{1}{3600}$$

Where L = average basin length, 3 ft → 2 ft
 W = average basin width, 3 ft → 2 ft
 a₀ = area of orifice at level 0, ft²
 a₁ = " " " " " 1, "
 a₂ = " " " " " 2, "
 a₃ = " " " " " 3, "

To drain from 2 ft to 1 ft:

$$T_d = \frac{LW(2-1)}{\frac{1}{2} C \sqrt{2g} [a_0(\sqrt{2} + \sqrt{1}) + a_1(\sqrt{1} + \sqrt{0})]} \times \frac{1}{3600}$$

To drain from 1 ft to 0 ft:

$$T_d = \frac{LW(1-0)}{\frac{1}{2} C \sqrt{2g} [a_0(\sqrt{1} + \sqrt{0})]} \times \frac{1}{3600}$$

DATE CHECKED	CHECKED BY	JOB NUMBER	BY	DATE	CALC. NO.	SHEET NO
		6160-50.5	CF	5/26/98		2/3
PROJECT		SUBJECT				
CAPTRANS		Extended Detention Basins - Time of Drainage				

Estimate Time of Drainage Through Orifices in Stand Pipe

Basin			coeff	(2g) ^{0.5}	Water Elev		0 level holes				1 level holes				2 level holes				Discharge Volume V cf	Flow at each Level			Total Flow Q cfs	Time to Empty Level		Basin T hr
L	W	ft			Init	Final	Elev	Numb	Diam	Area	Elev	Numb	Diam	Area	Elev	Numb	Diam	Area		q0	q1	q2		t		
		ft	H _i	H _f	El ₀	N ₀	D ₀ in	a ₀ sf	El ₁	N ₁	D ₁ in	a ₁ sf	El ₂	N ₂	D ₂ in	a ₂ sf	cfs	cfs	cfs	hr						
I-605/SR91 Site																										
86.1	17.2	0.66	3	2	0	1	0.5	0.00136	1	1	1	0.00545	2	1	1.5	0.01227	1480.92	0.011	0.035	0.032	5.2	0.079	86.5			
82.1	14.2	0.66	2	1	0	1	0.5	0.00136	1	1	1	0.00545	2	1	1.5	0.01227	1166	0.009	0.014		14.0	0.023	81.3			
78.1	11.2	0.66	1	0	0	1	0.5	0.00136	1	1	1	0.00545	2	1	1.5	0.01227	875	0.004			67.3	0.004	67.3			
I-5/I-605 Site																										
167	43.1	0.66	3	2	0	2	1	0.01090	1	2	1.5	0.02453	2	2	1.5	0.02453	7181	0.091	0.157	0.065	6.4	0.313	76.3			
162	40.1	0.66	2	1	0	2	1	0.01090	1	2	1.5	0.02453	2	2	1.5	0.02453	6504	0.070	0.065		13.4	0.135	69.9			
158	37.1	0.66	1	0	0	2	1	0.01090	1	2	1.5	0.02453	2	2	1.5	0.02453	5869	0.029			56.5	0.029	56.5			

I-5/I-605 Site - Check Capacity of 600 mm (24")
RCP Inlet Piping (Drainage System 1)

$$\text{Slope} = 0.2\%$$

$n = 0.013$ for concrete pipe

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2}$$

$$\frac{1.486}{0.013} AR^{2/3} = 226$$

$$Q_{full} = 226 (0.002)^{1/2} = 10.1 \text{ cfs}$$

$$= 4,536 \text{ gpm}$$

ok, peak flow for
1 yr, 24 hr storm = 2,343 gpm

Concrete Pipe
Design Manual
Pg. 5

Concrete Pipe
Design Manual
Table 3

DATE CHECKED	CHECKED BY	JOB NUMBER	BY	DATE	CALC. NO.	SHEET NO. 1/1
I-5/I-605 Site		6160-20.5	CF	5/20/98		
PROJECT	SUBJECT					
I-5/I-605 Site		Capacity of 600 mm RCP Inlet Piping				

I-5/I-605 Site - Drainage System No. 2 Outlet Piping

$$D = 600 \text{ mm (2 ft)}$$

$$n = 0.013 \text{ for RCP Pipe}$$

$$S = 0.06\%$$

$$Q_{\text{full}} = \frac{1.486}{0.013} (3.14) (0.5)^{7/3} (0.0006^{1/2}) = 5.52 \text{ cfs}$$

$$= 2,484 \text{ gpm}$$

Concrete Pipe Design Manual, Pg. 5

OK, more than adequate. Peak inflow to Basin = 2,343 gpm. Outflow pipe only has to release design storm volume = 96,325 gallons over > 24 hours = 27 gpm

DATE CHECKED	CHECKED BY	JOB NUMBER	BY	DATE	CALC. NO.	SHEET NO. 1/1
		6160-20.5	CF	5/18/98		
PROJECT Caltrans I-5/I-605		SUBJECT Capacity of 600mm RCP Outlet (Drainage System No. 2)				

I-605/SR91 Silt - Drainage System No. 3 Inlet Piping

300 mm drains:

$$d = 1 \text{ ft}$$

 $Q_{\text{total}} = 677 \text{ gpm} - \text{peak}$ to be handled by
2 300 mm (1 ft) drains

Check capacity of drains

material = Corrugated Steel Pipe

$$n = 0.030$$

$$Q_{\text{full}} = \frac{1.486}{n} AR^{2/3} S^{1/2} = \frac{1.486}{0.03} (0.785)(250)^{2/3} = 15.36 (S^{1/2})$$

Handbook of
Hydraulics,
Pg. 6-16

Drain a: $S = 1.027\%$, $Q_{\text{full}} = 15.36 (0.01027^{1/2})$
 $= 1.56 \text{ cfs}$
 $= 699 \text{ gpm}$

OK, $> 677 \text{ gpm}$ Drain b:

$$S = 3.947\%$$

$$Q_{\text{full}} = 15.36 (0.03947^{1/2}) = 3.05 \text{ cfs}$$

 $= 1,369 \text{ gpm}$
OK

600 mm drain

$$S = 1.50\%$$

material = RCP

$$n = 0.013$$

$$Q_{\text{full}} = \frac{1.486}{n} AR^{2/3} S^{1/2} = \frac{1.486}{0.013} (3.14)(0.5)^{2/3} (0.015^{1/2})$$

 $= 27.6 \text{ cfs}$
 $= 12,400 \text{ gpm}$

Concrete Pipe Design
Manual, pg. 5

DATE CHECKED	CHECKED BY	JOB NUMBER	BY	DATE	CALC. NO.	SHEET NO. 1/1
Coltrans I-605/SR91	Capacity of Drains					
PROJECT		SUBJECT				

Emergency Weir @ I-5/I-605 Site

Weir width = 2.4 m = 7'10"

$$C = CLH^{3/2}$$

$$H = 0.5 \text{ ft}$$

$$\text{weir height} = 3 \text{ ft}$$

$$H/P = 0.5/3 = 0.167$$

$$C = 3.235 + \frac{1}{60(0.5)^{0.56}} + 0.428(0.167)$$

$$= 3.43$$

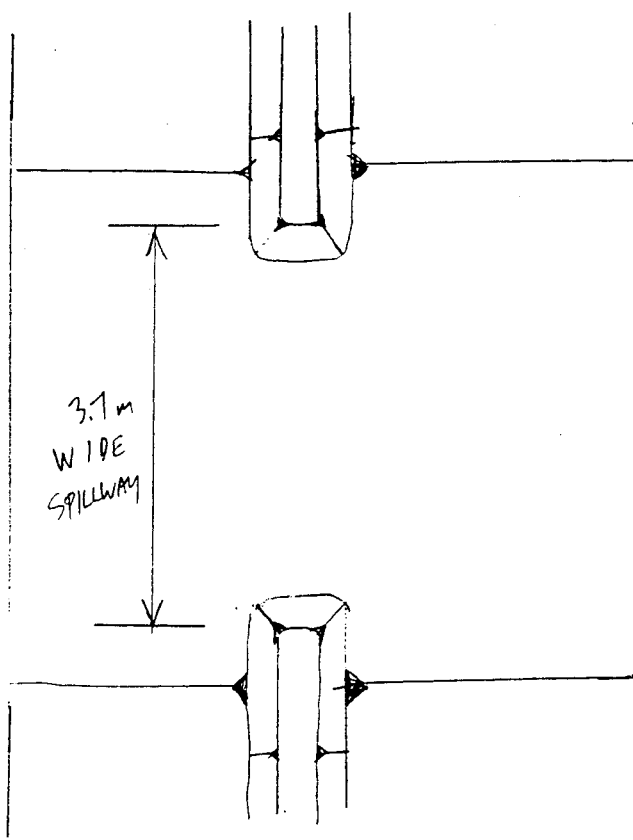
$$Q = 3.43(7.87)(0.5)^{3/2} = 16.97 \text{ cfs}$$

$$= 7,614 \text{ gpm}$$

Eqn. 5.29,
Handbook of
Hydraulics

DATE CHECKED	CHECKED BY	JOB NUMBER	BY	DATE	CALC. NO.	SHEET NO. 1/1
Caltrans I-5/I-605 Site		Emergency Weir				
PROJECT		SUBJECT				

Emergency Spillway @ the I-605/SR91 Site



Assume spillway functions similar to horizontal weir with end contractions

$$Q = CLH^{3/2}$$

C for spillway = 3 to > 4.0
assume 3.5

$$L = 3.7 \text{ m} = 12 \text{ ft}$$

H = 0.5 ft max. to avoid overflowing dike

$$Q = 3.5(12) 0.5^{3/2} = 14.8 \text{ cfs} = 6,664 \text{ gpm}$$

Handbook of
Hydraulics,
PS. 5-29

DATE CHECKED	CHECKED BY	JOB NUMBER	BY	DATE	CALC. NO.	SHEET NO.
		6160-20.5	CF	5/18/98		1/1
I-605/SR91 Site		Check Emergency Spillway Capacity				
PROJECT		SUBJECT				



APPENDIX D

COST ESTIMATES

ENGINEER'S ESTIMATE

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price (In Figures)	Item Total (In Figures)
1 (S)	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM	LUMP SUM	4,500.00
2	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM	LUMP SUM	25,000.00
3	129000	TEMPORARY RAILING (TYPE K)	M	120	100.00	12,000.00
4	150686	REMOVE IRRIGATION SYSTEM	ls	1	500.00	500.00
5	160101	CLEARING AND GRUBBING	LS	LUMP SUM	LUMP SUM	6,500.00
6	190101	ROADWAY EXCAVATION	M ³	880	11.00	9,680.00
7	198001	IMPORTED BORROW	M ³	2,020	10.00	20,200.00
8 (S)	203016	EROSION CONTROL (TYPE D)	HA	0.60	9,000.00	5,400.00
9	260201	CLASS 2 AGGREGATE BASE	M ³	142	31.00	4,402.00
10	390103	ASPHALT CONCRETE (TYPE B)	TONN	115	68.00	7,820.00
11 (F)	510502	MINOR CONCRETE (MINOR STRUCTURE)	M ³	24.8	950.00	23,560.00
12	650075	600 MM REINFORCED CONCRETE PIPE	M	65.5	300.00	19,650.00
13	664010	300 MM CORRUGATED STEEL PIPE (2.01 MM THICK)	M	92	150.00	13,800.00
14	681023A	PLASTIC PIPE (SPECIAL)	M	3.5	575.00	2,013.00
15	705566	600 MM AUTOMATIC DRAINAGE GATE	EA	2	1,800.00	3,600.00
16	707050	DRAINAGE INLET	EA	3	1,500.00	4,500.00
17	721009	ROCK SLOPE PROTECTION (FACING, METHOD B)	M ³	6.1	200.00	1,220.00
18	721012	ROCK SLOPE PROTECTION (BACKING NO. 3, METHOD B)	M ³	7.0	200.00	1,400.00
19	731420A	CONCRETE (BASIN LINING)	M ³	76.5	300.00	22,950.00

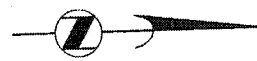
ENGINEER'S ESTIMATE (CONTINUED)

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price (In Figures)	Item Total (In Figures)
20	750001	MISCELLANEOUS IRON AND STEEL	KG	411	5.00	2,055.00
SUBTOTAL CONTRACT ITEMS						191,468.00
5% CONTINGENCIES:						9,574.00
GRAND TOTAL						201,042.00






APPENDIX E

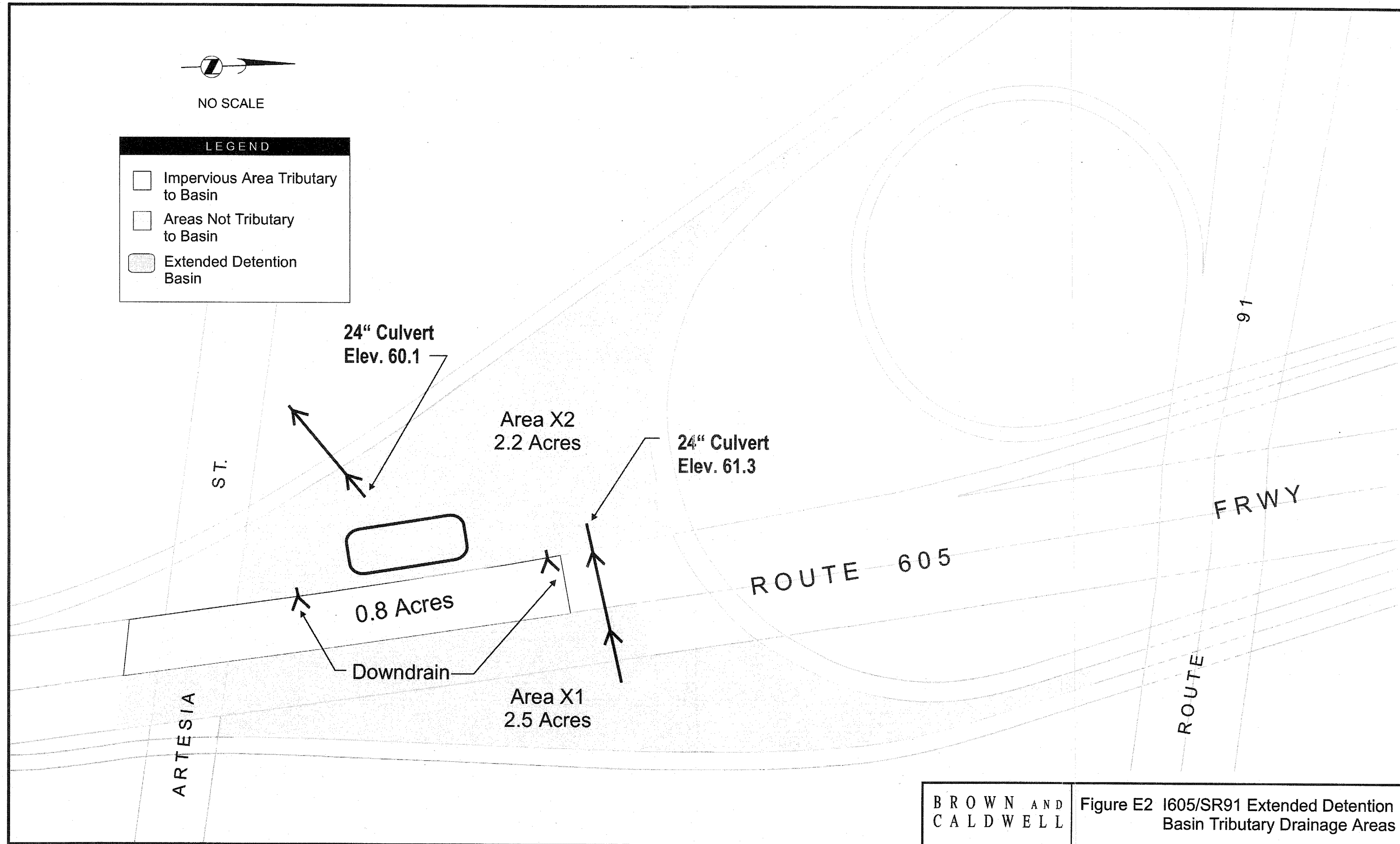
EXTENDED DETENTION BASIN TRIBUTARY DRAINAGE AREAS



NO SCALE

LEGEND

-  Impervious Area Tributary to Basin
-  Areas Not Tributary to Basin
-  Extended Detention Basin



BROWN AND
CALDWELL

Figure E2 I605/SR91 Extended Detention
Basin Tributary Drainage Areas



APPENDIX F

HYDROSEED MIX RECOMMENDATIONS



(Para 2 revised. One-column revisions)

(Use when straw incorporation IS NOT required)

(Use SSP 20-030_M when straw incorporated is required)

(It is preferable to use separate pay items for each material.

For small areas, may be paid for erosion control work by the area involved, e.g., acres or square yards)

(When more than one seed mix is required, revise the seed mix to "Seed (Type 1)" and "Seed (Type 2)" and add the appropriate locations, tables, materials and application rates.)

(Insert in Section 10-1. DO NOT insert in Section 10-2.)

USE CONTRACT ITEM CODE:

203045 PURE LIVE SEED (EROSION CONTROL)

10-1. EROSION CONTROL (TYPE D)

Erosion control (Type D) shall conform to the provisions in Section 20-3, "Erosion Control," of the Standard Specifications and these special provisions.

**

2*

(Para 2: Consult with District Landscape Architect and fill in appropriate dates. Erosion Control application period starting date and completed work date should be same)

Erosion control (Type D) work shall consist of applying erosion control materials to embankment and excavation slopes 1:4 (vertical:horizontal) or steeper disturbed or created by extended detention basin construction, other disturbed areas, and other areas designated by the Engineer. Erosion control (Type D) shall be applied during the period starting October 1 and ending April 1; or, if the slope on which the erosion control is to be placed is finished during the winter season as specified in "Water Pollution Control" elsewhere in these special provisions the erosion control shall be applied immediately; or, if the slope on which the erosion control is to be placed is finished outside both specified periods and the contract work shall be completed before October 1, the erosion control shall be applied as a last item of work.

3

Prior to installing erosion control materials, soil surface preparation shall conform to the provisions in Section 19-2.05, "Slopes," of the Standard Specifications, except that rills and gullies exceeding 50 mm in depth or width shall be leveled. Vegetative growth, temporary erosion control materials and other debris shall be removed from areas to receive erosion control.

MATERIALS.—Materials shall conform to Section 20-2, "Materials," of the Standard Specifications and the following:

4a*

(Use Para 4a OR Paras 4b thru 4g)

(Para 4a: Use when another erosion control SSP specifies the same seed specifications)

~~SEED.~~—Seed for erosion control (Type D) shall conform to the provisions specified for seed under "Erosion Control (_____)" elsewhere in the special provisions.

4b

(Paras 4b thru 4g: Use when seed is NOT specified elsewhere in the special provisions)

SEED.—Seed shall conform to the provisions in Section 20-2.10, "Seed," of the Standard Specifications. Individual seed species shall be measured and mixed in the presence of the Engineer.

4c

Seed not required to be labeled under the California Food and Agricultural Code shall be tested for purity and germination by a seed laboratory certified by the Association of Official Seed Analysts, or a seed technologist certified by the Society of Commercial Seed Technologists.

4d

Seed shall have been tested for purity and germination not more than one year prior to application of seed.

4e

Results from testing seed for purity and germination shall be furnished to the Engineer prior to applying seed.

4f

(Paras 4f thru 4f(g): Delete when legume seed is not required)

LEGUME SEED.—Legume seed shall be pellet-inoculated or industrial-inoculated.

4f(1)

Pellet-inoculated seed shall be inoculated with the provisions in Section 20-2.10, "Seed," of the Standard Specifications.

4f(2)

Inoculated seed shall have a calcium carbonate coating.

4f(3)

Pellet-inoculated seed shall be sown within 90 days after inoculation.

4f(4)

Industrial-inoculated seed shall be inoculated with Rhizobia and coated using an industrial process by a manufacturer whose principal business is seed coating and seed inoculation.

4f(5)

Industrial-inoculated seed shall be sown within 180 calendar days after inoculation.

**

4f(6)

Legume seed shall consist of the following:

4f(6a)*

(Para 4f(6a): Insert seed names, germination and application rates in the table. Increase or decrease rows in table as required. Do not edit column headings)

LEGUME SEED

Botanical Name (Common Name)	Percent Germination (Minimum)	Kilograms pure live seed per hectare (Slope measurement)
Trifolium hirtum 'Hykon' Hykon Rose Clover	85	.8
Lotus scoparius Deerweed	60	.2
Lupinus bicolor	80	1

**4g*

NON-LEGUME SEED.— Non-legume seed shall consist of the following:

4g(1)*

(Para 4g(1): Insert seed names, germination and application rates in the table. Increase or decrease rows in table as required. Do not edit column headings)

NON-LEGUME SEED

Botanical Name (Common Name)	Percent Germination (Minimum)	Kilograms pure live seed per hectare (Slope measurement)
Bromus carinatus 'Cucamonga' California Brome 'Cucamonga'	80	2
Eschscholzia californica California Poppy	75	1
Encelia californica	60	1
Melica californica California Melic	60	2
Nasella pulchra, Purple Needlegrass	60	4
Vulpia micostachys Small Fescue	80	2

4h

Seed shall be delivered to the job site in unopened separate containers with the seed tag attached. Containers without a seed tag will not be accepted.

4i

A sample of approximately 30 g of seed will be taken from each seed container by the Engineer.

****4j***

(Use Paras 4j OR 4k. Delete both Paras if 16-20-0 of the Standards Specifications is to be used)

(Para 4j: Edit for commercial fertilizer required)

COMMERCIAL FERTILIZER.—Commercial fertilizer shall conform to the provisions in Section 20-2.02, "Commercial Fertilizer," of the Standard Specifications and shall have a guaranteed chemical analysis range of 16 – 20 percent nitrogen, 7 – 10 percent phosphoric acid and 5 – 12 percent water soluble potash.

4k*

(Para 4k: Use when another erosion control SSP specifies commercial fertilizer to be used)

~~**COMMERCIAL FERTILIZER.** Commercial fertilizer for erosion control (Type D) shall conform to the provisions specified for commercial fertilizer under "Erosion Control (_____)" elsewhere in these special provisions.~~

COMPOST.—Compost shall be derived from green material consisting of chipped, shredded or ground vegetation or clean processed recycled wood products, or a Class A, exceptional quality biosolids compost, as required by US EPA, 40 CFR, part 503c regulations, or a combination of green material and biosolids compost. The compost shall be processed or completed to reduce weed seeds and deleterious material and shall not contain paint, petroleum products, herbicides, fungicides or other chemical residues that would be harmful to plant or animal life. Other deleterious material such as plastic, glass, metal or rocks shall not exceed 0.1 percent by weight or volume. A minimum internal temperature of 57 degrees Celsius shall be maintained for at least 15 continuous days during the composting process. The compost shall be thoroughly turned a minimum of five times during the composting process, and shall go through a minimum of 90 days curing period after the 15 day thermolitic compost process has been completed. The compost shall have a minimum maturity level of seven as measured on a Slovita test kit. Compost shall be screened through a minimum ¼ inch screen.

The moisture content of the compost shall not exceed 25%. Moisture content shall be determined by California Test 226. Compost products with a higher moisture content may be used provided the weight of the compost is increased to equal compost with a maximum moisture content of 25%.

Compost shall be prepackaged by the manufacturer and delivered to the project site in unopened bags. Compost will be measured and paid for by the kilogram in the same manner specified for commercial fertilizer in Sections 20-4.09 and 20-4.10 of the Standard Specifications.

Remove -

Paid under Erosion D

RD 5/27

41*

(Use Para 4l OR 4m. Delete both Paras if the types of straw in the Standard Specifications are acceptable)

STRAW.—Straw shall be derived from rice.

4m*

**

~~**STRAW.**—Straw shall be derived from wheat and barley. Wheat and barley straw shall not be derived from dry farmed cereal crops.~~

4n

STABILIZING EMULSION .—Stabilizing emulsion shall conform to the provisions in Section 20-2.11, "Stabilizing Emulsion," of the Standard Specifications and these special provisions.

4o

The requirement of an effective life of at least one year for stabilizing emulsion shall not apply.

4p

Stabilizing emulsion shall be in a dry powder form, may be reemulsifiable, and shall be a processed organic adhesive used as a soil binder.

**5*

(Para 5: Edit for number of applications)

APPLICATION.—Erosion control materials shall be applied in 3 separate application in the following sequence:

5a*

(Para 5a: Use when legume seed is applied by the dry method. Application rate must match total shown in Para 4f(6). Delete Para when legume seed MAY be applied with hydro-seeding equipment)

**

~~Legume seed shall be applied to a dry method at a rate of ___ kg/ha (slope measurement). Legume seed shall not be applied with hydro-seeding equipment.~~

5b

The following mixture in the proportions indicated shall be applied with hydro-seeding equipment within 60 minutes after the seed has been added to the mixture:

5b(1)*

(Para 5b(1): Delete "Legume Seed" row from table when Para 5a is used. If straw is to be used, delete commercial fertilizer from this application)

Material	Kilograms per hectare (Slope measurement)
Fiber	350
Non-Legume Seed	12
Legume Seed	2
Compost	1500

5c*

(Para 5c: Indicate application rate for straw-normally 4.0 tonnes per hectare for wheat or barley and 2 tonnes for rice)

Straw shall be applied at the rate of 3 tonnes per hectare based on slope measurements. Incorporation of straw will not be required.

5d

The following mixture in the proportions indicated shall be applied with hydro-seeding equipment:

5d(1)*

Material	Kilograms per hectare (Slope measurement)
Fiber	350
Commercial fertilizer	100
Stabilizing emulsion (solids)	450
Compost	1500

5e

The ratio of total water to total stabilizing emulsion in the mixture shall be as recommended by the manufacturer.

6

Once straw work is started in an area, the remaining applications shall be completed in the area on the same working day.

7

(Para 7: Delete when erosion control is paid for by the square meter or hectare)

~~The proportions of erosion control materials may be changed by the Engineer to meet field conditions.~~

8

(Paras 8 and 9: Delete when erosion control is paid for by the square meter or hectare)

MEASUREMENT AND PAYMENT.—~~The quantity of pure live seed (erosion control) to be paid for by the kilogram will be determined by multiplying the percentage of purity by the percentage of germination by the marked mass on the sack.~~

~~Pure live seed (erosion control) will be paid for by the kilogram in the same manner specified for seed in Section 20-3.07 of the Standard Specifications.~~The contract unit price paid per hectare for Erosion Control (Type D) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all work in erosion control, complete and in place, including seed, commercial fertilizer, compost, straw and stabilizing emulsion as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.